

CLAIMS:-

1. A method of routing an information packet over a label switched path between first and second end stations in a virtual private network defined over a network arrangement comprising a hierarchical arrangement of levels of routers, the method comprising attaching to the information packet at a network edge a sequence of labels indicative of a corresponding concatenated sequence of label switched path sections within the virtual private network, each said path section extending between a pair of said routers.
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2. A method as claimed in claim 1, wherein said network has a hierarchy of first, second and third levels of routers.
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3. A method as claimed in claim 2, wherein said sequence of labels comprises first, second, third and fourth labels.
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4. A method as claimed in claim 3, wherein each said virtual private network is defined by a network of quality of service capable tunnels each disposed between a respective pair of routers.
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5. A method as claimed in claim 4, wherein said first label defines a route from a first level router to a second level router, said second label defines a route from the second level router to a third level router, said third label defines a route from the third level router to a further second level router, and said fourth label defines a route from the further second level router to a destination first level router.
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6. A method as claimed in claim 5, wherein said label switched path sections are incorporated in dynamic multiplexed label switched paths comprising first-stage and second-stage Layer 1 constraint-based routed label switched paths.
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7. A method as claimed in claim 6, wherein a new session is multiplexed on to a said dynamic multiplexed label switched path only if the resource constraints of the first-stage and second-stage Layer 1 constraint-based routed label switched paths are satisfied.
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8. A method as claimed in claim 7, wherein the labels defining the sequence of tunnels are assigned during tunnel establishment.

9. A method as claimed in claim 8, wherein the labels defining the sequence of tunnels each identify a respective tunnel by means of a label switched path identifier.

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10. A method of selecting a series of tunnels between a source edge and a destination edge in a communications network having multiple central stages to provide a path having a quality of service guarantee, wherein resource availability from the source edge to the multiple central stages and from the multiple central stages to the destination edge is established, and wherein the selection is made by offering a number of candidate central stages to the destination edge and allowing the destination edge to select the complete path.

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11. A method as claimed in claim 10, wherein said network has a hierarchy of first, second and third levels of routers.

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12. A method as claimed in claim 11, wherein said path selection is identified by a stack of labels comprising first, second, third and fourth labels, and wherein said label stack is attached to an information packet routed on the selected path.

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13. A method as claimed in claim 12, wherein said first label defines a route from a first level router to a second level router, said second label defines a route from the second level router to a third level router, said third label defines a route from the third level router to a further second level router, and said fourth label defines a route from the further second level router to a destination first level router.

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14. A communications multi-service network comprising a plurality of nodes interconnected via quality of service capable tunnels and incorporating a frame-mode MPLS architecture, wherein end-to-end QoS guaranteed services are provided by defining a label stack which delivers packets through a concatenated sequence of tunnels defined by successive labels in the label stack.

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15. A communications network as claimed in claim 10, wherein said concatenated sequence of tunnels comprises label switched path sections incorporated in dynamic multiplexed label switched paths comprising first-stage and second-stage Layer 1 constraint-based routed label switched paths.

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16. A communications network as claimed in claim 11, wherein a new session may be multiplexed onto a said dynamic multiplexed label switched path only if the resource constraints of the first-stage and second-stage Layer 1 constraint-based routed label switched paths are satisfied.
17. A communications multi-service network as claimed in claim 12, wherein said network comprises a three layer a five -stage MPLS network, and wherein a stack of four labels is used to define a sequence of four tunnels within.
18. A communications network comprising a hierarchical arrangement of first, second and third levels of routers and over which one or more virtual private networks is defined, the network having a management system for routing packet traffic over a said virtual private network by attaching to each packet a sequence of four labels indicative of a corresponding concatenated sequence of label switched path sections within the virtual private network, each said path section extending between a pair of said routers.
19. A communications network as claimed in claim 18, wherein the first level routers comprise local routers, the second level routers comprise local tandem routers and the third level routers comprise national tandem routers.
20. A communications network as claimed in claim 15, wherein user access to the network is provided via a media gateway.
21. A method of determining a label switched path in a communications multi-service network comprising a plurality of nodes interconnected via quality of service capable tunnels to provide a QoS guarantee for a session in which resource availability from the network edge to multiple central stages and resource availability from the multiple central stages to the destination edge are established, the method comprising; selecting a series of said quality of service capable tunnels, wherein said tunnel selection is made by offering a plurality of candidate central stages to the destination edge and allowing the destination edge to select a complete path across the network.
22. A method as claimed in claim 21, wherein said network has a hierarchy of first, second and third levels of routers.

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23. A method as claimed in claim 22, wherein said sequence of labels comprises first, second, third and fourth labels.

5 24. A method as claimed in claim 23, wherein said network is defined by a network of quality of service capable tunnels each disposed between a respective pair of routers.

10 25. A method as claimed in claim 24, wherein said first label defines a route from a first level router to a second level router, said second label defines a route from the second level router to a third level router, said third label defines a route from the third level router to a further second level router, and said fourth label defines a route from the further second level router to a destination first level router.

15 26. A method as claimed in claim 25, wherein said label switched path sections are incorporated in dynamic multiplexed label switched paths comprising first-stage and second-stage Layer 1 constraint-based routed label switched paths.

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27. A method as claimed in claim 26, wherein a new session is multiplexed on to a said dynamic multiplexed label switched path only if the resource constraints of the first-stage and second-stage Layer 1 constraint-based routed label switched paths are satisfied.

25 28. A method as claimed in claim 27, wherein the labels defining the sequence of tunnels are assigned during tunnel establishment.

29. A method as claimed in claim 28, wherein the labels defining the sequence of tunnels each identify a respective tunnel by means of a label switched path identifier.

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